

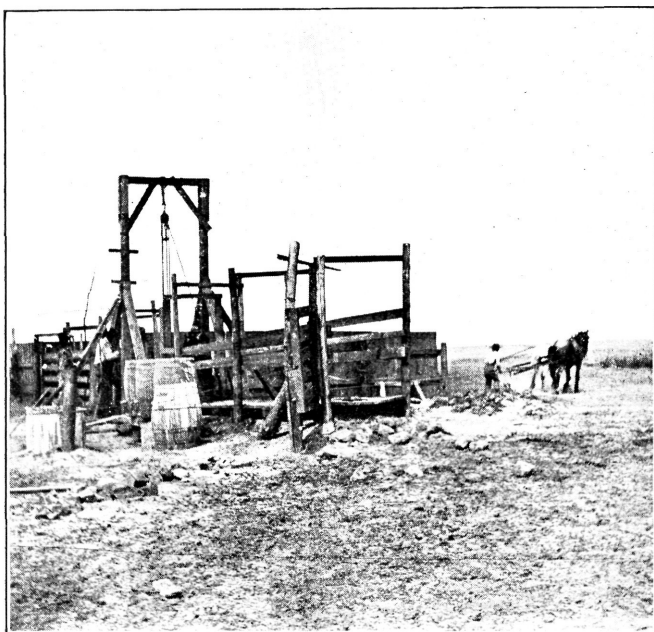


FIG. 1.—LANGEDAHL. RAISING CAGE LOADED WITH TWO YEARLINGS.

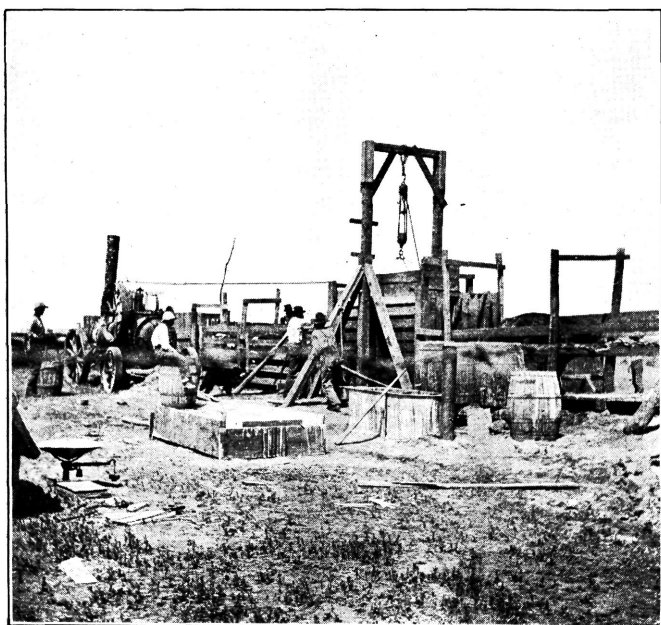


FIG. 2.—LANGEDAHL. STEER JUST LEAVING CAGE.

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U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF ANIMAL INDUSTRY—BULLETIN NO. 40.

D. E. SALMON, D. V. M., Chief of Bureau.

DESCRIPTION AND TREATMENT

OF

SCABIES IN CATTLE.

BY

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WASHINGTON:

GOVERNMENT PRINTING OFFICE.

1902.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., January 25, 1902.

SIR: I have the honor to transmit herewith a brief manuscript on the subject of Scabies in Cattle, by Dr. R. W. Hickman, chief of the miscellaneous division of this Bureau. Numerous requests for information have been received by this Bureau as to the character of this disease and the methods of treatment, and this paper has been prepared with a view to answering these inquiries. Accompanying the manuscript are specifications and drawings for making dipping vats, and also a list of lumber and hardware required.

Respectfully,

D. E. SALMON, *Chief of Bureau.*

Hon. JAMES WILSON,
Secretary of Agriculture.

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SCABIES IN CATTLE.

PRELIMINARY STATEMENT.

Numerous letters are addressed to this Bureau making inquiry with regard to a disease called Texas itch. As this disease does not exist except to a very limited extent, if at all, in Texas, it seems strange that this name should be applied to it. Dr. M. Francis, of the Texas Experiment Station, says that the disease has never been observed among the cattle of that State. It is also known as range itch, cattle itch, and cattle mange, the last being the correct name, as it really is mange, or scabies. This disease has prevailed to a considerable extent among the range cattle of the West and Northwest, and has been heard of in other portions of the country also, and inquiries are constantly received for instructions in its treatment.

CAUSE OF SCABIES, OR MANGE.

Scabies, or mange, of the ox is a contagious disease caused by a parasitic mite. Cattle are affected with two varieties of these parasites, which belong to the class Arachnidæ. The *Psoroptes communis* var. *bovis*, is the one which most frequently affects them. It lives on the surface of the skin and gives rise to great irritation and itching by biting, and is most frequent upon the lateral aspect of the neck and shoulders, at the base of the horns, and the root of the tail. From these points it spreads to the back and sides, and may invade nearly the entire body. Its principal manifestations are more or less numerous pimples, exudation, and abundant scaling off, or desquamation, of the skin, falling out of the hair, and the formation of dry gray-brownish scabs. In the course of time the skin becomes thickened, stiff, wrinkled, and acquires the consistence of leather. When mange has spread over a large surface of the body, the animals lose flesh and become weak and anemic, rendering them constitutionally less able to withstand or combat the effects of the mites. At the same time the decreased vigor and lessened vitality of the affected animals favor the more rapid multiplication of the mites and the further extension and intensification of the disease. Thus we have cause and effect working together,

with the result that scabies, or mange, in cattle may in some cases prove fatal; especially are fatal terminations liable to occur in the latter part of a severe winter among immature and growing animals, or those of adult and full age when in an unthrifty condition at the time of becoming infected. There have been noticed variations in the progress of the disease depending upon extreme seasons—aggravation in winter alternating with improvement in summer.

The mite which causes cattle itch, or mange, is closely related to the mite which causes sheep scab—both belonging to the same genus and species, but are different varieties. The sheep-scab mite will not attack cattle, nor will the cattle mite attack sheep or other animals. The itch mites are found to be very numerous upon affected cattle, and a very small quantity of debris from an actively infested area of the skin will often reveal a surprisingly large number of the parasites. These mites may be removed from an animal and retain their vitality for a long time. Specimens have been collected and kept in small glass bottles in the laboratory at the ordinary temperature of the room during the winter months varying from 45° F. during the night to 80° F. during the day, which would live and remain active from eight to eleven days. Exposure to bright sunlight, however, would kill most of the mites in a few hours.

Scabies does not appear to affect cattle while they are doing well on grass, nor attack those in good condition over three years old. The animals which suffer most are calves, yearlings, and two-year-olds, and those in poor condition. The first symptom of the disease is usually an intense itching of the skin about the neck or shoulders, and it extends more or less rapidly, depending largely upon the health and vigor of the animal, along the back and sides and down the outside of the legs, but does not usually affect the inside of the legs or the skin of the abdomen.

The other variety of this parasite which produces mange in cattle is the *Chorioptes symbiotes* var. *bovis*. This is known as symbiotic mange, or tail mange. It remains generally localized upon the depressions on the back part of the croup and at the base of the tail. It may, however, extend over the whole surface of the body if the treatment of the disease and care of the affected animals are neglected. These cases, however, are rare. Foot mange is also exceptional in cattle. Symbiotic mange has almost no spreading tendency, and its contagiousness is hardly noticeable. It yields readily to treatment and any remedy that will destroy the activity of the parasite producing the Psoroptic, or common, form of mange will readily kill that causing the symbiotic, or tail, mange. It is possible for the different morbid conditions produced by these two varieties of parasites (*Psoroptes communis* and *Chorioptes symbiotes*) to coexist.

FORM AND LIFE HISTORY.

The Psoroptes live upon the surface of the skin, adhere to it, and suck the blood and lymph of the skin by means of their mouth organs, producing a more or less intense inflammation through the numerous stings which they inflict. This species is characterized by its relatively greater size, its dimensions being 0.5 to 0.8 millimeter. Its general form is rounded or ovoid. It can be seen with the naked eye upon dark surfaces, and is very easily seen with the help of a magnifying glass. The head is elongated and pointed. The mandibles are long, straight, and stinging. The legs are very long. The sucking cups, tulip or trumpet shaped, are carried by articulated pedicles. In the male they are seen on the four pairs of legs; in the female, upon the first, second, and fourth pairs only. The Psoroptes in their immature form have three pairs of legs, while in the adult state they possess four. The latter with five joints are fitted with suction cups covered with fine hair and armed with claws or hooks. The head, thorax, and abdomen are not separated. The organs of mastication are represented by mandibles. The skin surface is covered with scales, hair, spikes, or silky hair, etc.

Females, which are larger than males, lay from 20 to 24 eggs; at the end of 4 to 7 days the larvæ come out, and after having undergone 3 or 4 metamorphoses, arrive at the stage of reproduction from the fourteenth to seventeenth day. If exposed to damp air, or placed upon wet manure, the mange parasites continue to live from 6 to 8 weeks. Upon damp ground the eggs remain alive from 2 to 4 weeks. In a dry place they lose their vitality after 4 to 6 days. Moderate heat is favorable to their vitality and to the hatching of the parasites.

In warm places under cover, and during the summer, their movements are more active and they multiply more rapidly than under the opposite condition. It has been estimated that one female alone may produce 1,500,000 individuals in 90 days.

Each animal species has its acari, or specific mange parasites; consequently, the expression "mange" must necessarily be incomplete unless the variety of the parasite is indicated. Thus of the Psoroptic acari, we have *Psoroptes communis equi*, which produces Psoroptic mange in the horse, *Psoroptes communis bovis* in the ox, and *Psoroptes communis ovis* in the sheep.

In each of these animals we also have the symbiotic mange, and in each the variety would be designated as in the case of the Psoroptic form; but in neither variety is the contagion transmitted from one species of animal to the other. The symbiotes live especially upon the surface of the skin of the extremities, and exist in epidermic scabs. They are from 0.3 to 0.5 of a millimeter in diameter. Their outlines are visible to the naked eye or with the magnifying glass.

The head is short, and wider than long. The body is slightly ovoid and notched upon the periphery. The legs are long and the sucking cups are shaped like a Roman shield, and are distributed in both the male and female, as in the case of the same organs on the legs of the Psoroptes.

Sarcoptic mange is a more serious disease than either of those already described, but is not common to cattle. It would not, therefore, seem important to refer to this form of mange parasite and occupy space in this bulletin except by a reference to the serious disease which is produced by the Sarcoptes through certain characteristics natural to them. We find Sarcoptic mange in the following domesticated animals—horse, sheep, goat, dog, cat, and pig.

The Sarcoptes dig subepidermic galleries and live on the plasma cells of the malpighian layer. They multiply in these galleries and occasion a very intense dermatitis, or inflammation of the skin. Because of the depth to which the Sarcoptes burrow, Sarcoptic mange is exceedingly hard to eradicate. It would, therefore, seem fortunate that this form of the disease is not common to cattle. It is rebellious to all medication, and very frequently recurrences of the disease produced by the Sarcoptes are seen in other species of animals after treatment which has been prolonged for months.

Concerning the transmissibility of the different manges to animals and man, we find that all Sarcoptes may live for an indefinite period upon man's skin, but the Psoroptes and Symbiotes die very rapidly and occasion but slight irritations. The horse may contract Sarcoptic mange of the sheep, pig, dog, and cat. The ox takes the Sarcoptes of the horse, sheep, goat, and cat. The sheep contracts Sarcoptic mange of the goat. The dog takes the Sarcoptes of man, pig, cat, sheep, and goat. The pig contracts Sarcoptic mange of the goat. From this it will be seen that Sarcoptic mange, unlike the Psoroptic and Symbiotic manges, is transmissible from one species of animal to another.

Mange is never developed except by contagion. The period of incubation—that is, the interval that lapses between the moment when the acari are deposited upon the surface of the body and the appearance of the disease on the skin—varies according to the number of parasites transmitted. When in small numbers, the first manifestations of mange are sometimes only seen at the end of 4 to 6 weeks, while at other times the disease may be clearly apparent at the end of 15 days. Contamination takes place either by direct contact—that is, immediate, as on pasture, at the stable, etc.—or by intermediary agents.

DISINFECTION.

What has already been said with regard to the contagious character of scabies in cattle—of the number of scab mites which may be found in a small quantity of the débris of the skin and their ability to live and remain active for a considerable length of time under unfavorable conditions—will indicate the importance of the thorough disinfection of corrals, sheds, or buildings in which affected cattle may have been kept. It is therefore necessary, in order to attain success in the treatment of this disease, to destroy parasites which have fallen off or have been dislodged from the animals as well as those that are upon them; otherwise there is danger of their becoming reinfected from the premises after the effects of the remedy applied to the animals have disappeared.

TREATMENT.

Methods in operation for the treatment of scabies in sheep have become more or less familiar to all people interested in sheep husbandry, and it may be said that the same treatment so successfully applied in ridding sheep of scabies has been found equally efficacious in the treatment of scabies in cattle.

In 1898 the Bureau of Animal Industry issued Bulletin No. 21, entitled "Sheep Scab: Its Nature and Treatment," which gives a description of this disease in sheep, its cause and treatment, with numerous formulas for the preparation of dips, and illustrations of the methods of applying them, together with directions for their use on both a large and small scale. The treatment of such large animals as cattle, which are difficult to handle, both because of their size and the conditions under which they live—the latter making them more or less intractable—would require a considerable amount of any preparation thoroughly to wet all parts of their bodies; next to effectiveness, therefore, small expense is the first object that must be considered. In the treatment of cattle for scabies, it seems fortunate that the dips of lime and sulphur, both of which are inexpensive, have proven effective and entirely satisfactory. During the past season thousands of cattle have been successfully treated for mange in the State of North Dakota, which work has been carefully investigated and observed by Dr. Robert H. Treacy, an inspector of this Bureau, who has furnished diagrams and photographs of the various plants, and who states that the dip which has been universally used in that section is that designated in Bulletin No. 21 as the No. 3 South African (Cape Town) official lime-and-sulphur dip (February 4, 1897), which is as follows:

Flowers of sulphur	pounds..	21
Unslaked lime	do....	16½
Water	gallons..	100

Place the unslaked lime in a mortar box or some suitable vessel and add enough water to slake the lime and form a lime paste or lime putty. Sift into this lime paste the flowers of sulphur and stir the mixture well. Be sure to weigh both the lime and sulphur, and do not trust to measure them in a bucket or guess at the weight. Place the sulphur and lime paste in a kettle or boiler with about 25 or 30 gallons of boiling water, and boil the mixture for two hours at least, stirring the liquid and sediment. The boiling should be continued until the sulphur disappears, or almost disappears, from the surface. The solution is then of a chocolate, or liver, color. The longer the solution boils the more the sulphur is dissolved, and the less caustic the ooze becomes. Most writers advise boiling from thirty to forty minutes, but a much better ooze is obtained by boiling from two to three hours, adding water when necessary. Pour the mixture and sediment into a large tub or barrel, placed near the dipping vat, and provided with a bung-hole about 4 inches from the bottom, and allow it ample time (from two to three hours or more if necessary) to settle. The use of some kind of a settling tank provided with a bung-hole is an absolute necessity, unless the boiler is so arranged that it may be used for both boiling and settling. An ordinary kerosene oil barrel will answer very well as a small settling tank. To insert a spigot about 3 to 4 inches from the bottom is an easy matter. Draining off the liquid through a spigot has the great advantage over dipping it out in that less commotion occurs in the liquid, which therefore remains freer from sediment. When fully settled, draw off the clear liquid into the dipping vat and add enough warm water to make 100 gallons. The sediment in the barrel may then be mixed with water and used as a disinfectant, but under no circumstances should it be used for dipping purposes. A double precaution against allowing the sediment to enter the vat is to strain the liquid through ordinary bagging as it is drawn from the barrel or settling tank.

The above directions are for the quantity of dip given in the preceding formula. Any multiple of the constituents may be used, depending upon the capacity of the boiler, vessels, and tank to be filled, but, let it be repeated, that there should be no guessing about the proportions; that the directions for the preparation of the dip as here given should be closely followed, care being taken that boiling be continued for the full time recommended, and that the sediment is not used for dipping purposes.

In order to attain success in the treatment of mange, care and thoroughness of method must be observed. Animals that have been exposed should be dipped as well as those that show distinct evidences of the disease. After the lapse of a few weeks following the first dipping, the animals should be subjected to a second dipping, in order that parasites which may have survived the first treatment, or that

may have gotten on the animals from corrals, sheds, buildings, or elsewhere, may be destroyed. Several thousand cattle were carefully examined by our inspector forty days after being put through the dip for the second time and he failed to find evidence of scabies on any of them. These animals commenced to improve soon after being subjected to the first dip, as the dip killed lice as well as the scab mites, and owners of cattle adjacent to the dipping plants have declared their intention to dip in future years to kill lice, even if scabies does not exist. The dip liquid in the tanks during the whole dipping process should be kept at a temperature of from 102° to 110° F. Each animal should be kept two minutes in the dip, and be put completely under twice during that time. All bad cases should be hand-rubbed and kept in the dip four minutes.

Pregnant cows have been treated, as well as cattle of all ages, from calves to full-grown steers, with the loss of but one animal in one of the swimming tanks. This was a steer which for some reason seemed to be unable to swim and was drowned. It would appear that the dipping of cows has no appreciable effect upon abortions, as a comparison with previous years showed that the dipping had not increased the average number of abortions regularly occurring among these herds before dips were used.

DIPPING PLANTS.

Of the various dipping plants in use, there are but two kinds that need description—the small dipping plant, which is inexpensive and suitable for use by a community of farmers, and the larger dipping plant with swimming tank, such as would be needed if large numbers of range cattle are to be treated. A suitable plant for a community of farmers has been built for \$150, while a swimming tank will cost \$350.

Such a plant as that in operation 18 miles north of Steele, N. Dak., known as the Langedahl, would seem to be an admirable example of the smaller kind. This plant, with the exception of the tank, was built by farmers. A thrashing engine was used for heating purposes by connecting a 1½-inch pipe to the whistle intake, the whistle being removed, and the pipe joined to the union. The plant has a capacity of 200 head per day. Its cost, without engine or labor, excepting the labor to build the tank or vat, was \$150. One person can easily lower the cage when loaded by taking a hitch around a post, and it may be raised, as shown in illustrations, either with engine or horses. (See frontispiece.)

Following are the drawings and list of materials for the smaller plant, the tank of which may be filled with dip made as per preceding formula for about \$7.50. Drawings and list of materials were furnished by Dr. Robert H. Treacy.

LIST OF MATERIALS.

Entrance pen and chute.

65 plank 2 inches x 6 inches x 16 feet.

28 posts.

18 braces 4 4 4 .

Tank, or vat.

800 feet good 2-inch plank.

400 running feet tongue strip.

10 pieces 4 inches x 4 inches x 16 feet.

2 pieces 2 6 16 .

10 pounds lead.

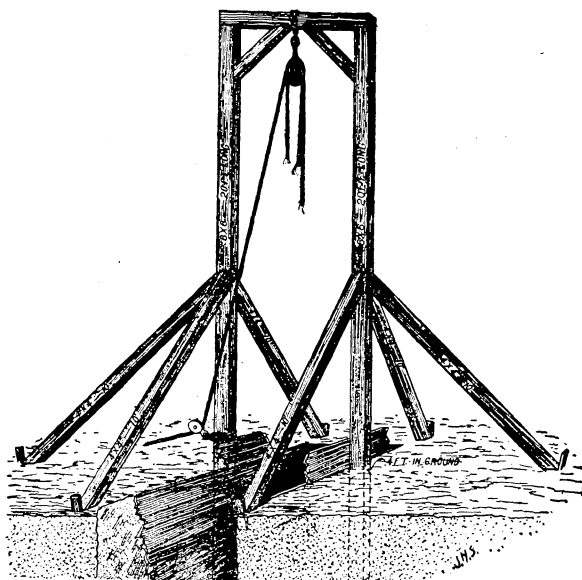


FIG. 1.—Derrick. Sixteen ft. high above ground. Derrick posts 4 ft. in ground, 6 by 6 by 20 ft. long. Braces 4 by 4 by 10 ft. long; 2 double-leaf 6-in. blocks at top of derrick, and 1-leaf 5-in. pulley at bottom of derrick; 100 ft. of 1-in. rope.

Cage.

8 pieces 4 inches x 4 inches x 16 feet.

8 pieces 2 4 16 .

12 pieces 2 10 16 .

10 pieces 1 10 16 .

4 half-inch iron rods, with ring in each end, 5½ feet long.

2 half-inch iron rods, with ring in each end, 4 feet long.

3 pair of heavy hinges.

Derrick.

2 pieces 6 inches x 6 inches x 20 feet.

1 piece 6 6 10 .

6 pieces 4 4 12 .

Drip chute.

10 pieces 2 inches x 6 inches x 14 feet.
 4 pieces 2 12 14
 4 pieces 4 4 16
 1 pair heavy hinges.
 1 gallon tar.

Holding pen.

32 cedar or oak posts.
 200 pounds wire.
 5 pounds staples.

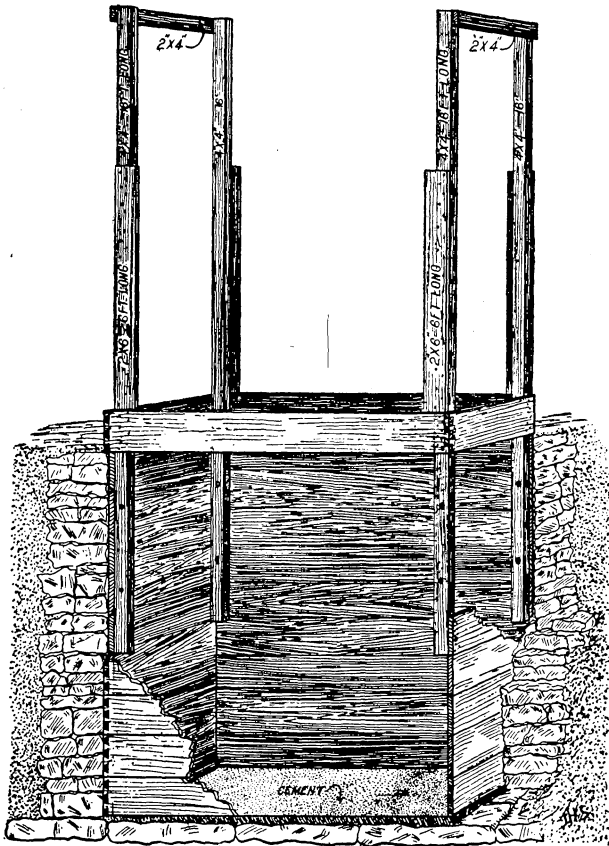


FIG. 2.—Vat. Tank 10 ft. deep, 4 ft. wide, 9 ft. in ground. Should contain from $5\frac{1}{2}$ to 6 ft. of dip. Standards 4 by 4 by 16 ft. long, bolted to tank inside, to extend 6 ft. inside of tank, to act as guides to cage; 2 by 6 in. plank 6 ft. long nailed to outside of standards; 2 by 4 or 2 by 6 in. braces across top of standards. The tank should be built of 2-in. plank and joined with a tongue, the ends of the tank mortised in, the joints coated with lead. The braces are 4 by 4. The tank, being placed in the ground and packed solid, does not require much bracing. The tank should be laid in cement bottom, with stone and mortar about sides.

Hardware and incidentals.

- 100 pounds 20-penny spikes.
- 20 pounds 40-penny spikes.
- 2 6-inch double-leaf blocks.
- 1 5-inch single-leaf block.
- 100 feet 1-inch rope.
- 25 feet 1½-inch iron pipe.
- 1 galvanized-iron heating tank (5 barrels capacity).
- 4 oil barrels.

A plant of this capacity will answer very well in a community where various owners have bunches of cattle ranging from 80 to 100 head or

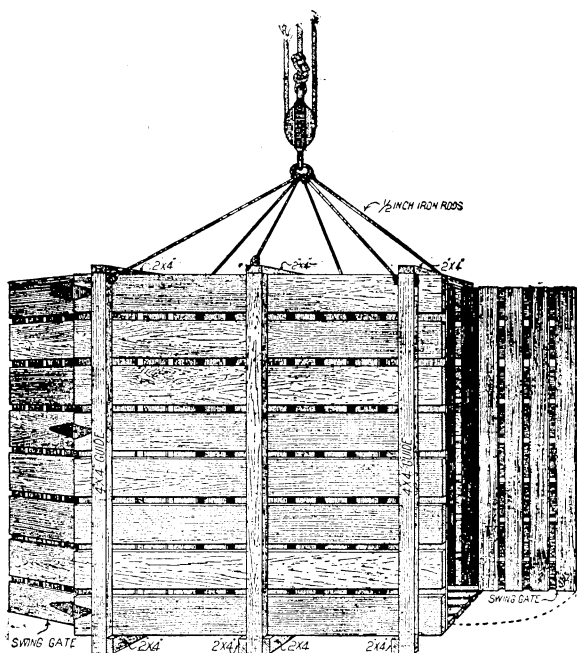


FIG. 3.—Cage. Eight ft. long, 8 ft. high, 2½ ft. wide—inside measurement; 2-in. plank used for outside boarded up and down inside with 1-in. boards to keep animals from climbing up sides. Plank 2 in. apart. Inside boards 2 in. apart, and 1-in. cracks in floor to allow free escape of dip fluid.

less. Among its chief advantages over the swimming tank are cheapness in construction, because of its size, and proportionately smaller expense in operating; the dip can be kept at the required temperature with facility, because of its lesser volume, and the submerging of the animals, as well as the length of time it is desired to keep them in the dip, can be more easily regulated.

In communities where mange does not exist and where numbers of small herds are infested with lice, a plant of this character might be constructed and used with profit to the cattlemen. Many of the cattle that were dipped during the past year because of having been exposed

to mange, or scabies, by being herded with those affected, showed much improvement in condition soon after dipping, as they were

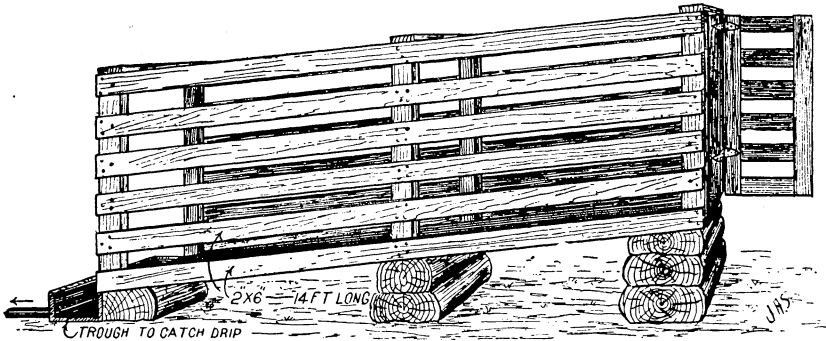


FIG. 4.—Drip chute. Fourteen ft. long; 2 by 6 in. plank; 5 ft. high. Set with 18-in. slope from front to rear. Trough at rear to catch drip, from which a pipe may be run to connect with tank to carry drip from drip chute back into tank. Floor of drip chute should be tight to prevent waste.

infested with lice to a considerable extent, although showing no distinct evidence of being affected with mange. It was observed that the lousy and mangy cattle stopped rubbing or digging after the first dip,

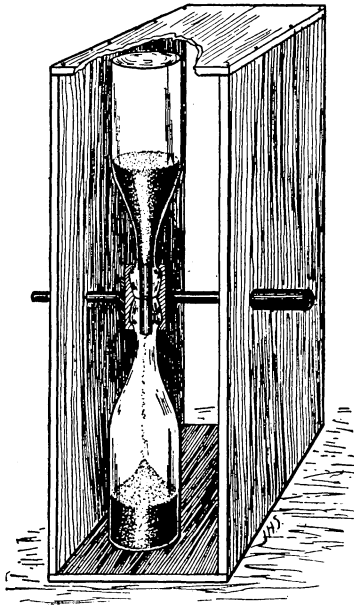


FIG. 5.—Sand glass. For timing the animals in the dip. Is made of two ordinary ketchup bottles connected by a hollow wooden cork, placed in a box, and the box hung on a pin through the center to revolve, as shown in the illustration.

and improved rapidly after being relieved of the torture that is inflicted by both of these troublesome parasites—scab mites and lice.

SPECIFICATIONS FOR LARGE DIPPING PLANT WITH SWIMMING TANK.

The following plans and specifications are for the construction of such a dipping plant as that of the Rice Lake Cattle Company, which is located 12 miles north of Sterling, N. Dak., and are in accordance with the drawings made for that company after the following specifications:

SPECIFICATIONS.

Specifications of labor and materials required in the construction of a cattle dipping plant to be built at ———— for ————, in accordance with drawings made for the same by A. Van Horn, of Bismarck, N. Dak.

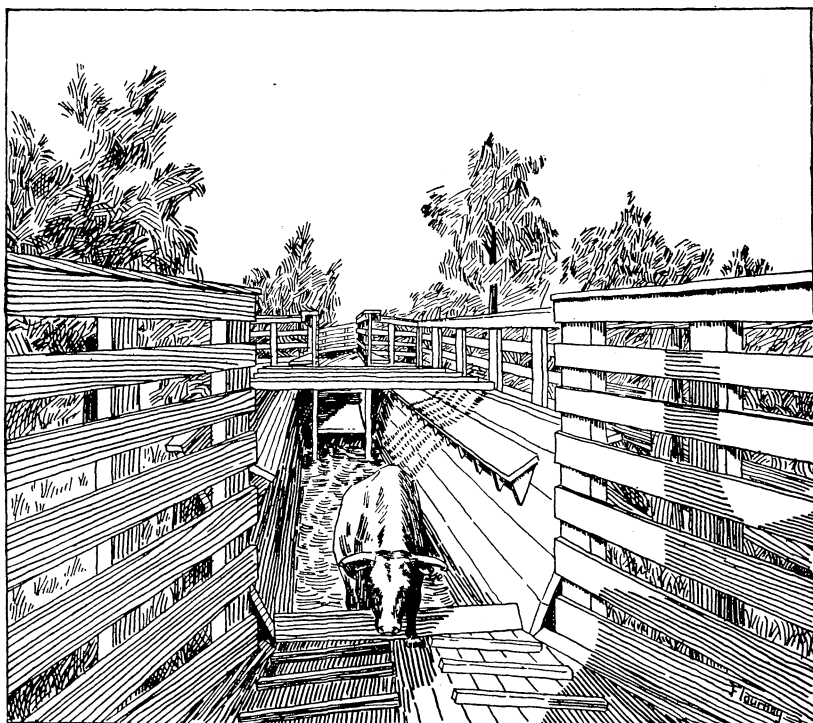


FIG. 6.—Steer emerging from dipping vat, or swimming tank of large plant.

Excavations.—Excavate for the vat, as shown by the drawings, to the proper depth; level the bottom of the pit for the sills of the vat. After the vat is completed and the outside has been coated with coal tar, fill in around the vat, using the surplus earth to bank up and grade the sides of the vat above the natural grade, sloping the banks from the vat. Dig all holes required for the gate and fence posts.

Carpenter work.—All work must be done in a skillful and workmanlike manner; the framework of the vat to be bolted and spiked together; the plank of sides, ends, and bottom of the vat and dripping floor to have edges beveled for the calking as per detail, well driven together and well spiked with 20d. wire nails, using 40d. nails on the 3-inch plank. Calk all seams with oakum, well driven in with a calking iron and pitched. The exit, or inclined end, of the vat to have 3-inch bottom plank; all

other plank of the vat and dripping floor to be 2 inches thick. Top of vat to be tied with 4 x 4 inch ties across top, framed and bolted to uprights as shown. Put 2 x 12 inch splash boards on sides at top of vat, nailed to under side of tie timbers and braced. The exit end of vat and dripping floor to be cleated with $1\frac{1}{2}$ x 3 inch strips, well nailed to floor and bottom. Construct the trap at entrance—30 x 84 inches—of

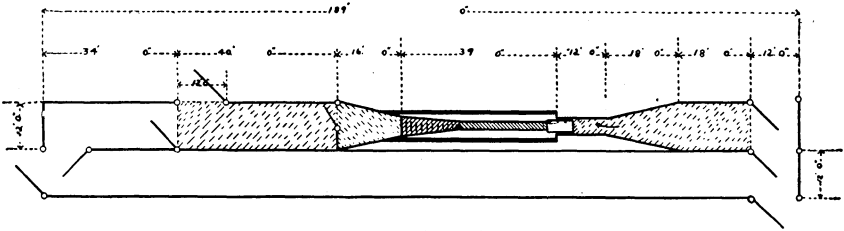


FIG. 7.—Plan of dipping plant, viewed from above.

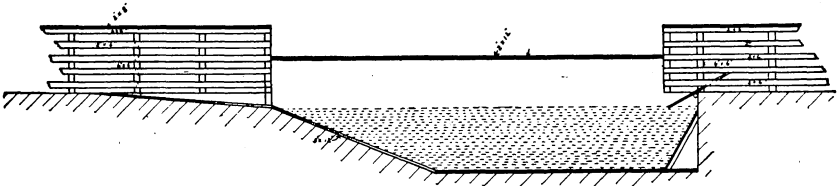


FIG. 8.—Vertical section of dipping vat, with older-style automatic trap on pivot. It will be seen that the incline at the bottom of the trap end of the vat is in a perpendicular line with the free end of the trap; where the spring trap is used, the length of the incline should be increased in order that at the bottom of the vat it may still be in line perpendicularly with the end of the trap when set; otherwise cattle are liable to get back under the trap, causing trouble.

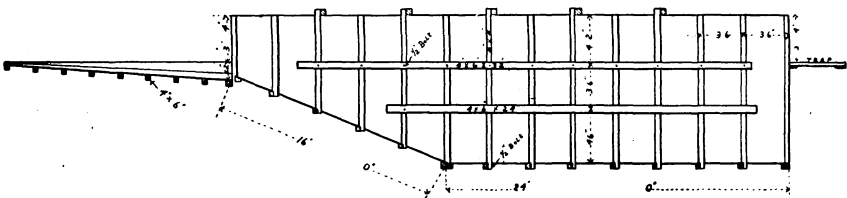


FIG. 9.—Side view of dipping vat, showing inclined egress and dripping floor.

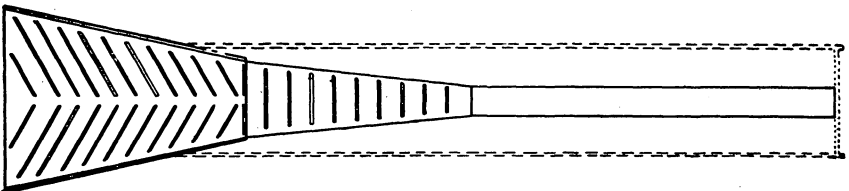


FIG. 10.—Swimming tank with incline and drip chute, looking from above.

2-inch plank, with 2 x 10 inch battens bolted together, top to be covered with 14-gauge sheet steel. Trap to swing on a 2-inch wrought-iron pipe or 2-inch steel bar seated in the end of vat, with $\frac{1}{2}$ x 4 x 12 inch iron sockets bolted to vat. Secure the trap to the axle with iron straps bolted to under side of the center battens. End of vat to have false back as shown.

Gates and fence.—Construct and erect the gates and fence as per drawings. The gate post to be set 4 feet in the ground and the fence posts 3 feet 6 inches. Set all posts plumb and to a line; well and thoroughly tamp the earth around the posts. The bottom of all posts to be coated with coal tar before being set. Gate posts to be

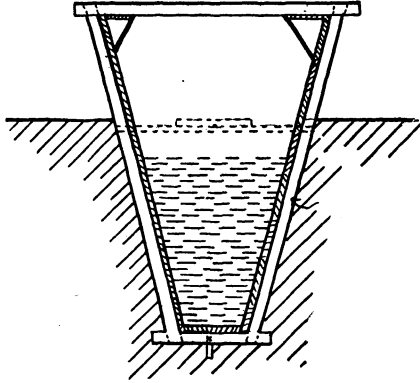


FIG. 11.—Vertical section of swimming vat, showing end of trap.

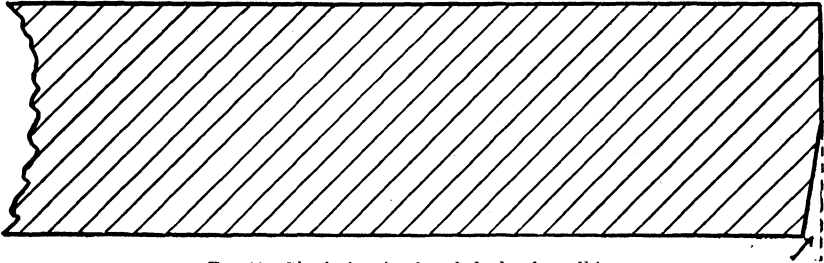


FIG. 12.—Plank showing beveled edge for calking.

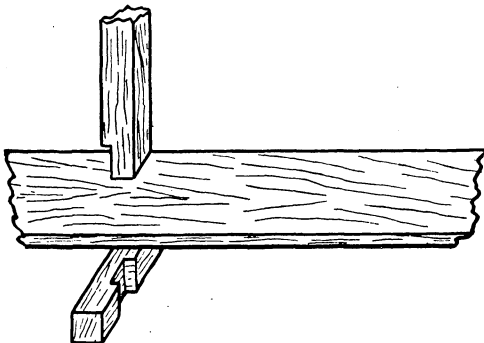


FIG. 13.—Sill and upright, showing method of joining.

8 x 8 inches, with 6 x 8 inch tie framed and driftbolted to the posts. Fence posts to be 6 x 6 inches. The gates to be bolted and spiked together and braced as shown. To be hung with $\frac{1}{2}$ x 3 x 36 inch strap eye-and-bolt hinges. Bolt to run through posts and hinges bolted to gates. Gates to have $\frac{1}{2}$ x 3 x 16 inch iron hasp bolted to gates and a suitable bolt staple, with iron pin and chain for locking.

Fence.—The fences to be five-railed, with cap, ribbon fence. Rails, or ribbons, to be of 2 x 6 inches, with 2 x 8 inch cap, spiked at each bearing with two 40d. wire nails. Posts to be set 8 feet on centers, or nearer where distance may require.

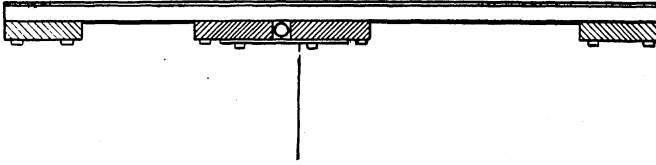


FIG. 14.—Vertical section of an older style of automatic trap, showing 2-in. iron pipe upon which trap is pivoted.

Lumber.—All lumber to be to No. 1 pine or fir dimension, free from shakes, bark, large pitch pockets, unsound knots, or other imperfections that materially impair its strength, durability, and use for which it is intended.

Drainage.—The vat to have a 2-inch waste pipe fitted in the bottom with gate valve and elbow, and 20 feet of pipe to run horizontally under ground, with a fall of 2 feet on 16 feet. At this point the owner will take up the drainage without cost to the contractor, and continue the same to a suitable point either by pipe or open ditch.

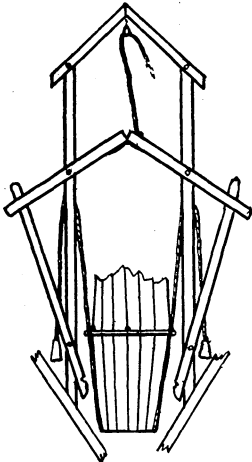


FIG. 16.—Spring trap sprung. This trap is hung on an iron rod or on a 2-in. iron pipe; weights are attached at the free end to pull it back in place; it then sets automatically.

Dimensions of vat.—Perpendicular depth of vat to be 10 feet; width at top, 7 feet; width at bottom, 2 feet; length of level bottom, 24 feet; horizontal length of sloping bottom, 15 feet; width of dripping floor at upper end, 12 feet; at lower end, 5 feet.

Floor of pens.—Should the owner decide to floor the catch pen and holding pen No. 1, the floor will be of 2-inch plank nailed to 4 x 4 inch joist or sleepers let into the ground and leveled. The sleeper to receive one coat of coal tar before being laid.

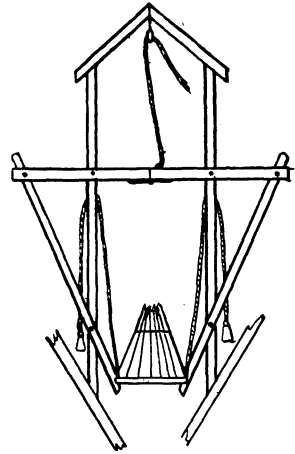


FIG. 15.—Spring trap set.

LUMBER BILL.

Vat and dripping floor.

Plank for sides, ends	1,080 feet = 30 pcs.	2" x 12" x 18'	No. 1 pine or fir.
False back and bottom.....	576	24	2 12 12 "
	64	2	2 12 16 "
	96	2	2 12 24 "
	or 3		
	240	5	3 12 16 "
	72	2	3 12 12 "

	24 feet =	1 pc.	4'' x 4'' x 18'	No. 1	pine or fir.		
Sills, uprights, and ties -----	{	37	2 pcs.	4	4	14	"
		64	3	4	4	16	"
		32	2	4	4	12	"
		27	2	4	4	10	"
		64	2	4	6	16	"
		336	21	4	4	12	"
		96	4	4	4	18	"
		21	1	4	4	16	"
		19	1	4	4	14	"
Splash boards.....	160	4	2	12	20	"	
Cleats	54	9	1½	3	16	"	
Trap	{	23	1	2	10	14	"
		30	1	2	10	18	"
Total.....		3,115 feet.					

Gates.

Posts.....	896 feet =	14	pcs.	8'' x 8'' x 12'	No. 1	pine or fir.
Tie beams	448	8	6	8	14	"
Ribbons.....	480	40	2	6	12	"
Braces	144	8	2	6	18	"
Battens or rails	96	6	2	6	12	"
	128	4	4	6	16	"
Total	2,192 feet.					

Fence.

Posts	2,010 feet =	67 pcs.	6'' x 6'' x 10'	No. 1	pine or fir.		
Ribbons	{	240	20	2	6	12	"
		140	10	2	6	14	"
		1,760	110	2	6	16	"
		450	25	2	6	18	"
Caps	{	64	4	2	8	12	"
		32	2	2	8	14	"
		469	22	2	8	16	"
		120	6	2	8	18	"
Total.....		5,285 feet.					

NOTE.—Oak or cedar posts are to be preferred. If round cedar posts are used, substitute 10-inch round posts for the 8 x 8 inch and 8-inch round posts for the 6 x 6 inch posts as above.

For catch pen.

There should be a plank floor in the catch and holding pen No. 1, but if only a limited number of cattle are to be dipped this may be omitted.

If it is decided to floor these pens the following material should be added to the foregoing lumber bill:

For holding pen No. 1.....	240 feet =	15 pcs.	4'' x 4'' x 12'	No. 1	pine or fir.
	850	"	2''	pine or fir plank,	12'' x 18'.
	240	"	=	15 pcs.	4'' x 4'' x 12', No. 1 pine or fir.
	960	"	2''	plank	18'.

Total 2,290 feet of additional lumber.

Cottonwood lumber may be used where the market price of same would make it practical.

SCHEDULE OF HARDWARE, ETC.

Vat and dripping floor.

42 carriage bolts, $\frac{1}{2}$ " x 6", with washers.

40 " $\frac{1}{2}$ 8 "

18 " $\frac{1}{2}$ 4 "

40 lbs. 20d. common wire steel nails.

10 " 30 " "

15 " 50 " "

1 sheet No. 14 sheet steel, 30" x 84", with 1 gross 1" No. 10 screws.

20 lbs. oakum.

40 " pitch

10 gals. coal tar.

5 feet 2" pipe or steel bar, for trap.

21 " 2" wrought-iron pipe, with couplings.

1 elbow, 2".

1 flange for securing pipe to bottom of tank, 2".

1 gate valve, 2".

Gate and fence.

8 pairs eye-and-bolt hinges, heavy, $\frac{1}{2}$ " x 3" x 36".

8 hasps, $\frac{1}{2}$ " x 16" x 3", with bolt staple, for 8" posts.

48 bolts, $\frac{1}{2}$ " x 3".

20 " $\frac{1}{2}$ 4 $\frac{1}{2}$

68 " $\frac{1}{2}$ 6

160 " $\frac{1}{2}$ 4

32 driftbolts, $\frac{1}{2}$ " x 12".

20 lbs. 30d. common wire nails.

65 " 40 " " "

16 gal. coal tar.

NOTE.—If catch and holding pen No. 1 is to be floored, add to the above 30 lbs. of 30d. wire nails and 5 gallons coal tar.